Pit and Quarry

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II:6

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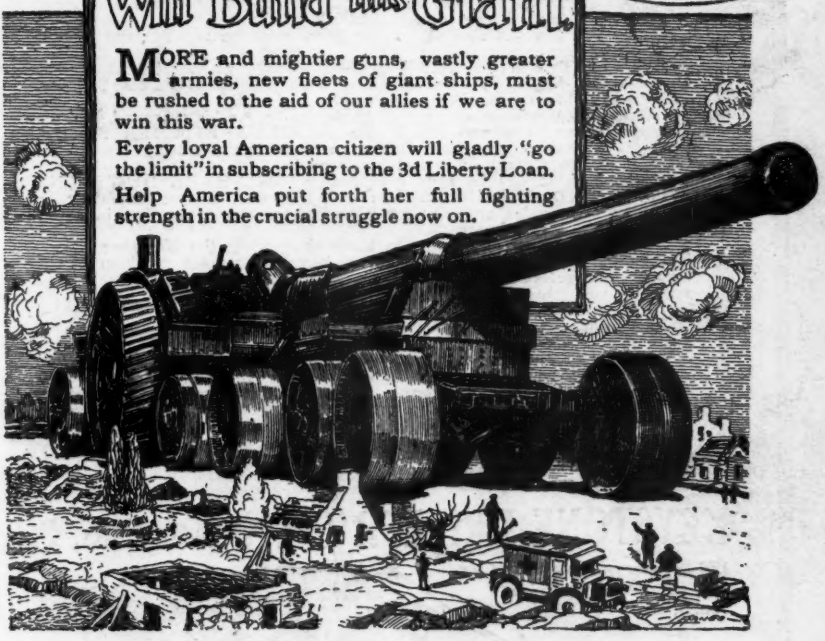

MAY, 1918

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KEYSTONE 10-TON TRACTION STEAM SHOVEL

HERE IS A LIGHT TRACTION STEAM SHOVEL that will go anywhere you could take a loaded dump wagon. A 15-mile jaunt in ten hours, over decent roads, is easy for it.

IF YOU HAVE A STRIPPING JOB, or if you wish to accurately separate two strata of clay or sand, the flat bottom half-yard SKIMMER SCOOP will do your work as nothing else could.

IN SHALLOW CUTTING, 6 in. to 2 ft., this little shovel will beat the big ones in daily output. Its 16-ft. boom and 11-ft. horizontal crowding movement give it the bulge on shallow work.

And it will DRIVE ITS SCOOP INTO THE TOUGHEST FIRE-CLAY, gravel, shale or anything, in fact, but solid rock.

There are dozens of KEYSTONE excavators DIGGING BITUMINOUS COAL, in open pits.

You can LOAD FROM STORAGE PILES of crushed stone, sand, gravel or coal, into freight cars, industrial cars or wagons.

And you can get around quickly from your quarry to your storage dump and vice versa.

AGAINST A HIGH BANK of sand or clay, where all strata are to be mixed in digging, you would, of course, use the DIPPER SCOOP, which works like the ordinary type of steam shovel.

When necessary to cut below grade, as in working around the top of your quarry face, you should use the DRAW DITCHER SCOOP, which is a positively controlled dragline attachment, cutting toward the machine and to a depth of 16 feet below grade.

The machine can be thus equipped WITH THREE DIFFERENT SCOOPS AND ATTACHMENTS: The Skimmer, Dipper and Ditcher. They are inexpensive and you can change from one to another in a few minutes. The cost is low.

It will give you confidence to know that, while the Keystone Shovel is comparatively a newcomer, there are already over 400 of them in use among contractors and quarrymen, and they have won enthusiastic approval.

Besides, the machine is sponsored by the Keystone Driller Co., which is by no means a newcomer in the manufacturing field, having been in business at Beaver Falls, Pa., since 1882.

The photographs reproduced in OUR SHOVEL CATALOG show the machine on dozens of different jobs and they will show you more in a minute than we could tell you in an hour. They are supplemented by many pages of cuts reproduced from drawings prepared by our Engineers. The accompanying text is fully descriptive and contains such data as you will require to determine what could be expected of the Keystone Excavator on your work. Drop us a line NOW.

KEYSTONE DRILLER CO., Beaver Falls, Pa.

170 Broadway, New York City
Monadnock Block, Chicago
Joplin, Mo.

Pit and Quarry

Vol. 2 Chicago, Ill., May, 1918 No. 6

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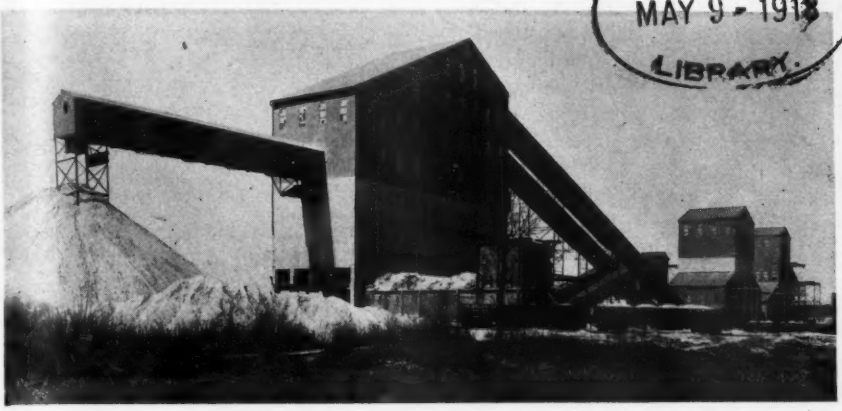


PLANT OF DOLESE & SHEPARD CO. AT GARY, ILL.

Big Capacity Obtained Electrically

Centrally Controlled Quarry Cars, Individually Housed Crushers and Elaborate Screening System at Dolese & Shepard's Mammoth Plant

DOLESE & SHEPARD CO., Chicago, Ill., operates a mammoth crushed stone plant at Gary, Ill., which has notable time and labor-saving features in both the quarry and in the crushing and conveying buildings. The capacity is 6,000 cubic yards per ten-hour day, and to attain this, much of the machinery is automatic. With the exception of the steam shovels the plant is electrically operated. It uses the Woodford system of centrally controlled cars in the quarry, which now has an opening of 80 acres. The plant is about 15 miles southwest of Chicago. The company has 300 acres of land, of which 130 acres are available for a stone quarry to a depth of 250 feet. At present the quarry's face is 40 feet. The present plant was built in 1909 from plans furnished by The J. C. Buckbee Company, of Chicago, which acted as engineers for the entire works.

Much of the product is 5-inch flux for the numerous blast furnaces and steel mills in and about Chicago, there being special bins for this material. The remainder of the plant is devoted to all sizes down to agricultural limestone.

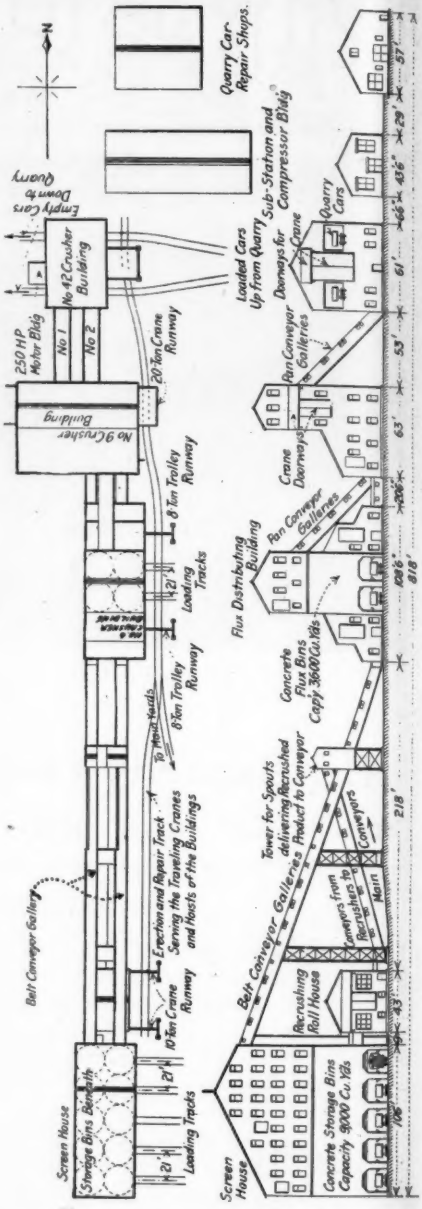
There are four Bucyrus steam shovels, one of which does the stripping, the others loading the broken stone

into the dump cars. All cars are side-dump, standard gauge, and of special design, built by Kilbourne & Jacobs, Columbus, Ohio, each having a wooden body 10 by 9 feet wide and 3 feet deep, lined with steel plates and mounted on steel trucks. When dumping, the door is automatically swung upward and outward. Each car weighs 17½ tons. The quarry is circular, but longer than it is wide. On the quarry floor are two tracks making a continuous circuit, the inside track being for a lower level, and a number of switches, as shown by the diagram. The third rail, which carries the current for operating the cars, extends middle distant between the rails of each track.

Control of the Cars

Two men in the controlling tower, located at the edge of the quarry near the crusher house, are able by levers and push buttons to operate each car independently from any of the others. The switches and cross-over tracks are also electrically operated from the tower. Cars can be started or stopped at will, for the reason that the third rail is divided into sections separated by insulated joints, each section having independent connection with the controlling apparatus in the tower. While each car is usually 1,000 feet on its way to the crusher before the next car is loaded, still it is possible to avoid collisions by means of brakes which automatically set on the rear car by a current from the first car when too near one another. The cars on each section can be controlled independently of those on any other section, although those on the same section are controlled in the same way as a unit. The levers in the tower operate the electric controllers on the cars, and the push buttons are for the electro-pneumatic track switches and the cross-overs. Each car has two 30-h. p., 200-volt motors.

Drilling is done by seven "Cyclone" drills making 5-inch holes. After the



blasting, shovels pick up the broken stone, as previously mentioned. Leaving the shovels, the cars proceed to the crushing plant, and in order to get upon the main track they can be switched about at the will of the man

VIEW SHOWING ABOUT HALF OF THE QUARRY.

in the controlling house. At the floor of the quarry near the crushing plant, a track leads off the main track and up a 6 per cent incline, turns a curve to the right on a grade of 3 per cent, and continues upward on a steel trestle with a grade of 6 per cent to the crushing house. Here it is 40 feet above the ground and 80 feet higher than the quarry floor. Just before reaching the mouth of the crusher a switch is extended around the crusher, making it possible to dump on both sides of the crusher.

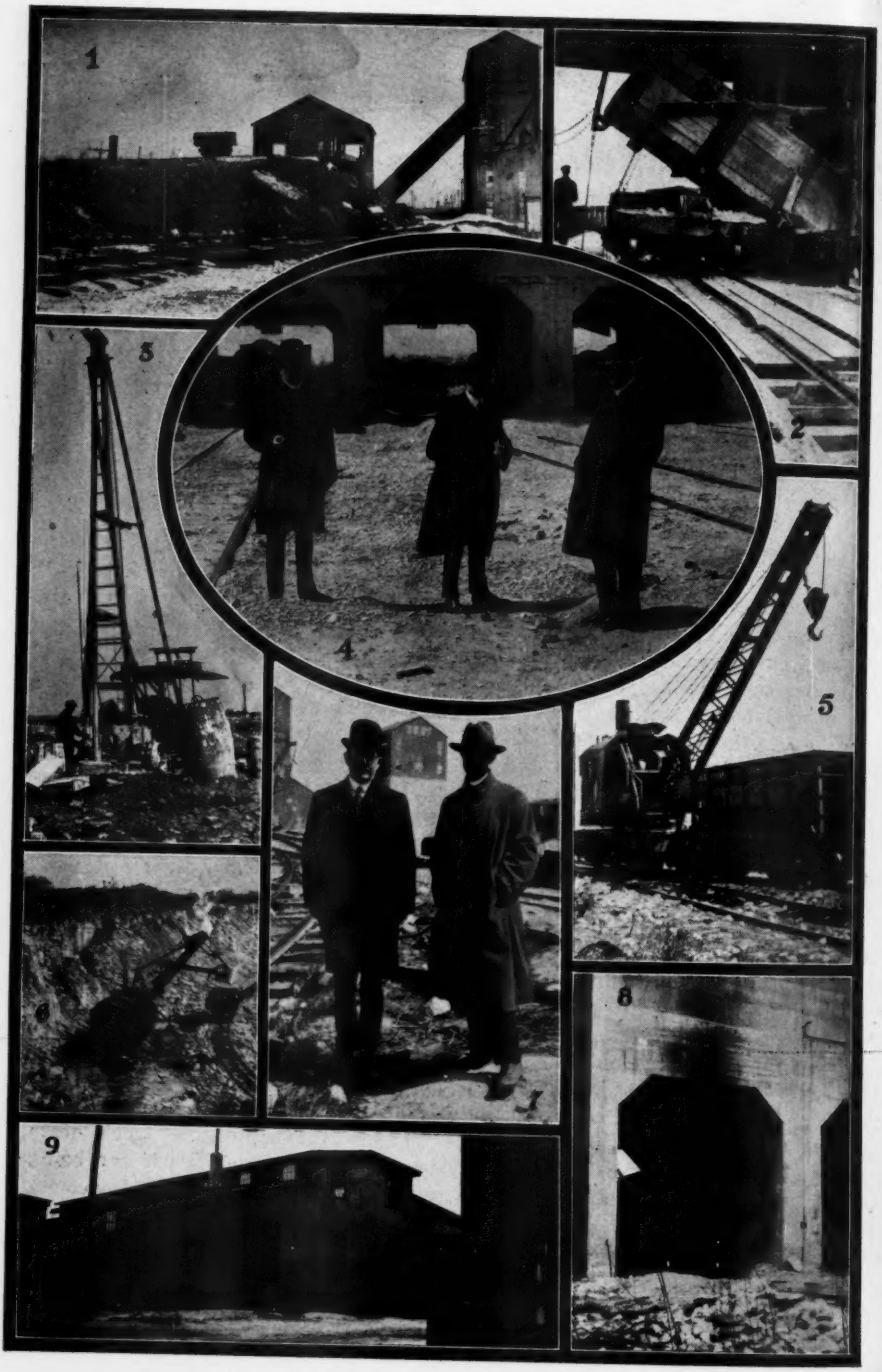
HOW THE CARS ARE DUMPED

Dumping is effected electrically by a man in charge of this department. This is the only point at which the men in the tower do not have control. Hooks attached to an overhead shaft parallel with the tracks lift one side of the car, tilting it so that the stone slides out into a steel chute which passes it into the crusher's mouth. The lifting apparatus is counterbalanced by a suspended concrete beam. After dumping, the car rights itself and the door is closed and latched automatically. The time required for dumping is one minute per car.

It then passes down an 8 per cent incline on the other side of the crusher house, makes a semi-circle to the right and passes under the incline first mentioned, there being a bridge at this point in the first incline, thus in leaving the quarry and returning, a complete but elongated circle is described. (See diagram.)

After dumping, the car again comes within control of the controlling station and coasts down the incline, the third rail being dead at this part of the track. The car's momentum becomes the motive power and the motor becomes the generator. The speed is, therefore, automatically governed, so that no attention is required from the operator until it passes to the quarry and as far as the loading point. Here he switches it from the main track to the loading track.

There is an automatic track scale on the first incline. Each car being non-interfering, a signaling device indicates at the scale at what shovel that car was loaded and the weight of the load. Because of this a daily record of the performance of each shovel is made. A great advantage in operating cars singly, it is claimed, is that they are not compelled to wait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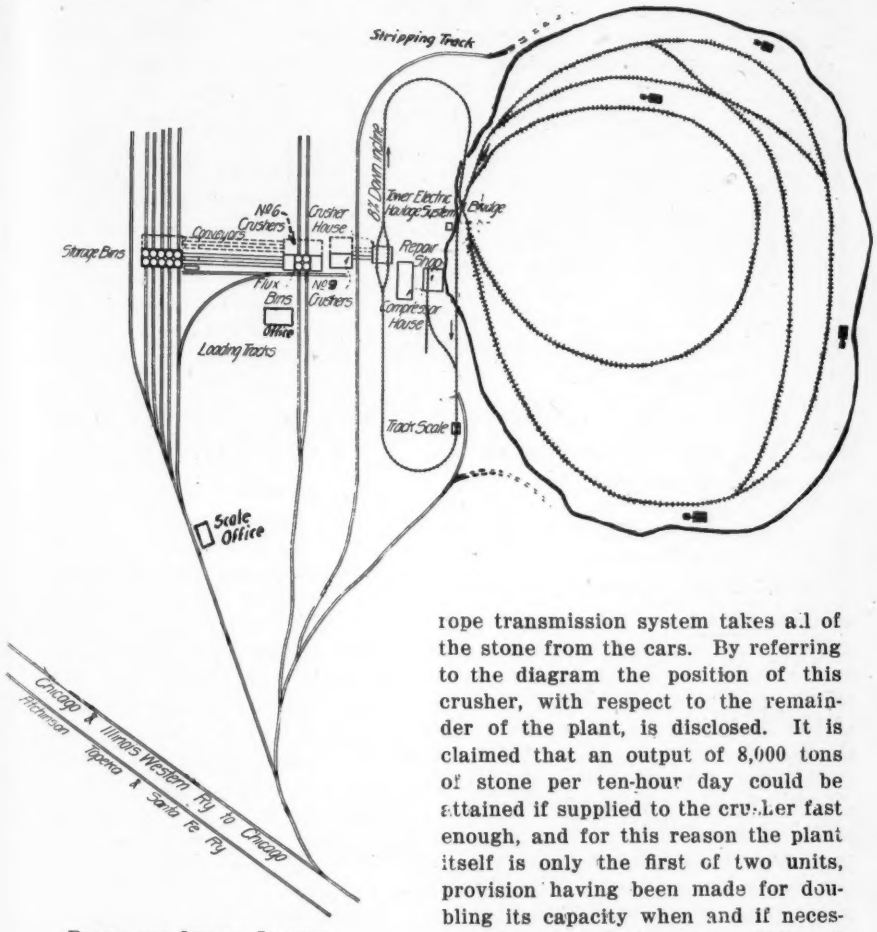
Explanation of Pictures on Opposite Page

1. Empty car returning to quarry. 2. Dumping into the big crusher. 3. One of seven drills. 4. J. J. Sullivan, V. P. and Gen. Mgr.; J. C. Buckbee, designer of plant, and J. F. Talbot, President. 5. Locomotive crane has numerous duties. 6. One of four steam shovels. 7. J. J. Sullivan and Supt. G. T. Chambers. 8. Loading tracks. 9. Office.



PLANT AND QUARRY LAYOUT.

for other cars to be loaded. It is stated, also, that this method eliminates the need of a large number of cars.

CRUSHER HAS BIG CAPACITY

A No. 42 McCully crusher, operated by a 250-h. p. motor by means of a rope transmission system takes all of the stone from the cars. By referring to the diagram the position of this crusher, with respect to the remainder of the plant, is disclosed. It is claimed that an output of 8,000 tons of stone per ten-hour day could be attained if supplied to the crusher fast enough, and for this reason the plant itself is only the first of two units, provision having been made for doubling its capacity when and if necessary, but the erection of an additional buildings. The stone is reduced to a 6-inch size, discharged into two openings on opposite sides, which passes it to two 114-foot bucket elevators (Power & Mining) having overlapping steel buckets 54 inches wide and 24 by 24 inches in section,

which are attached to steel bars having flanged wheels leading on the conveyor tracks. The conveyors have an incline of 45 degrees and deliver into a large steel bin which feeds automatically to two No. 9 crushers, one of Gates and the other Power & Mining make, each driven by a 100-h. p. motor. The stone is reduced to 5 inches or less and sent to two revolving screens under each crusher, 4 feet in diameter and 24 feet long (Power & Mining), having 2½-inch perforations.

The Screens

That which does not go through the screens falls into two 120-foot, 45 degree, pan conveyors having buckets 4 feet wide and 24 by 24 inches in section, driven by a 60-h. p. motor, carrying the material for fluxing purposes to four circular bins in the flux storage building, which also houses four No. 6 Gates crushers. The 2½-inch and under stone passing through the two screens is carried by belt conveyors directly to the No. 6 crushers, which deliver to two 24-inch belt conveyors, running horizontally, to two 30-inch belt conveyors on the 330-foot incline leading to the main screen house. These were furnished by The Gutta Percha & Rubber Mfg. Co., Chicago. On another page is shown a remarkable picture of one of the mammoth belts rolled up, being nearly 10 feet high. The flux stone, just mentioned, can also be run into the No. 6 crushers and up this incline into the main screen house, if desired. The long incline is on an angle of 23 degrees, each belt being operated by a 60-h. p. motor.

In the main screening house there are twelve screens, four of them being of the revolving type, 4 feet in diameter and 28 feet long, with jackets; four revolving screens, 4 by 24 feet, and four shaking screens, 3 by 12 feet. The first named receive the stone from the long belt conveyors, each belt delivering to two screens, the rejections of which are in turn sent into the 24-foot screens. The stone that passes through the ½-inch perforations in the upper end of the first revolving screens is delivered to two of the shaking screens, which separate it into smaller sizes, and it is then passed to the storage bins.

Recrushing Plant

A large recrushing plant consisting of two sets of rolls 54 inches in diameter and 24 nches wide, stationed on the ground at the foot of the main screening house, receives the rejections from the screens, recrushing them and delivering to two belt conveyors 24 inches wide, which rise at an angle of 20 degrees and which in turn deliver to the two long belt conveyors leading to the top of the screening house.

The bins are all cylindrical and constructed of reinforced concrete, each being 20 feet inside diameter, 32 feet high, with walls 8 inches thick. Each holds 500 cubic yards. There are four of these for the fluxing stone in the No. 6 crusher building, and ten in the main screening house. The spaces between the bins are also utilized for storage purposes. The bottom of the bins rest on a 14-inch slab of reinforced concrete the size of the entire building, which is supported by girders on heavy rectangular reinforced concrete columns. Each bin has a spout and outlet gate at the bottom and clears the railroad track underneath by 22 feet. A car a minute can be loaded.

The plant has been so designed that each one of its two sides can be operated alone, if desired; also, as stated, the capacity can be doubled by building another unit. The fines are carried by a belt conveyor from the main screen house to a storage pile outside of the building, as shown

[Continued on page 216]

Crushing House and Storage Bins of the Lehigh Stone Co., near Kankakee, Ill.

Flexible Crushing Plant

Nest of Crushers Fills Small Space—Material Can Be Returned from Bins to Crushers—Special Arrangement for Agricultural Limestone Department.

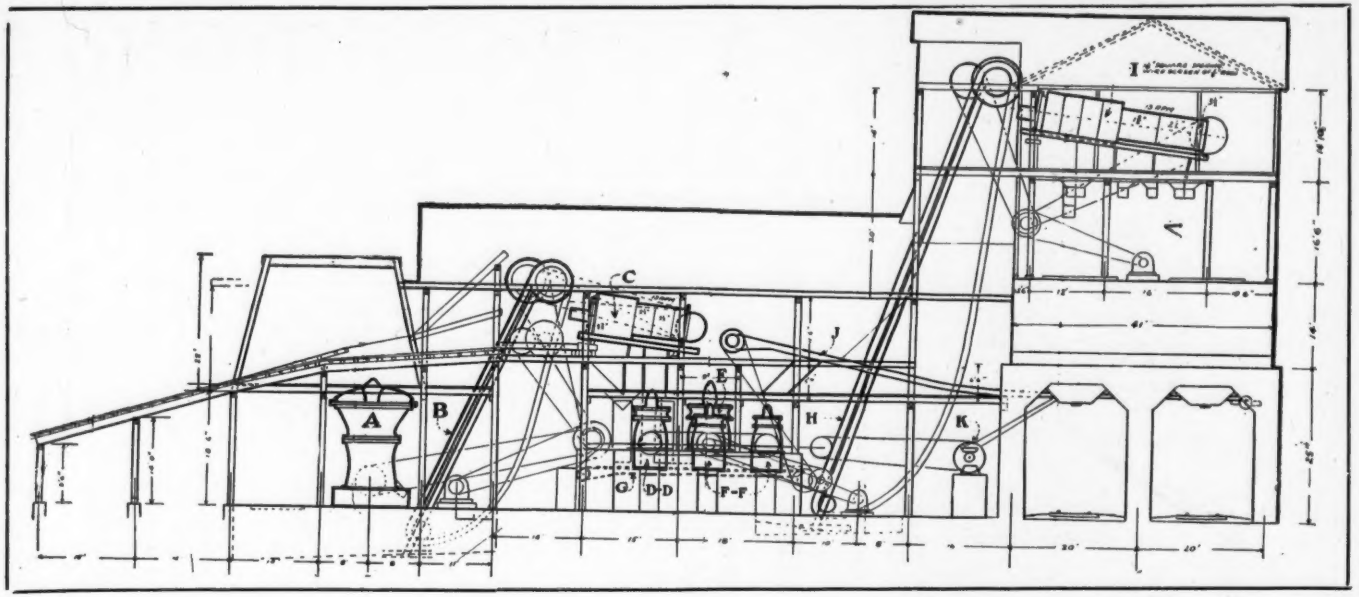
EIGHT MILES WEST of Kankakee, Ill., the Lehigh Stone Co. has erected a new plant that has been in operation only a few days. It is remarkable in many ways, but its principal feature is its flexibility, that is, being able to produce on short notice any combination of its various sizes. The expectation is, too, that the output will be large, much greater than is usual for the amount of machinery involved.

There is no question but what the plant is extremely efficient and represents the latest ideas of design. The diagram shown here will illustrate this statement: The machinery is arranged to occupy a comparatively small space; all, except one, shaft bearings are higher than the head, and besides it isn't every plant that can run crushed material from the bins to the crushers and back again, or has wide, clean platforms to walk about its machines and bins. The incline is short, though not too steep. The bins are of reinforced concrete and have platforms underneath to facilitate the opening of the spouts when loading railroad cars.

Quarry Opened in Straight Line

The quarry has been opened so as to be operated in a straight line. The stone has only about 30 inches of soil on top and lays in laminations about 5 inches thick in even and almost horizontal stratifications. It is of high quality, very hard and almost white, and a peculiar characteristic is the fact that there is no rotten rock at the top.

Three "Clipper" drills bore the blast



holes, 5⅝ inches in diameter and 12 to 14 feet deep. A Bucyous No. 70 steam shovel does both the stripping and picks up the broken stone, working toward the plant; the shovel, however, started at a point middle distant. One shot loosens a month's supply. The stone is lifted to 4-yard Peteler side-dump cars which are pushed to the incline by a 36-inch gauge dinky locomotive, and then pulled up to the crusher head by a Power and Mining friction hoist. There are 16 cars, working in 4-car trains. While their capacity is 4 yards, 5 yards are reg-

M. J. Edgeworth, President, and W. R. Sanborn, General Manager.

ularly loaded onto them, thus each train consists of 20 yards.

Five Crushers in a Nest

A No. 36 Power and Mining "Superior" gyratory crusher (A) takes the stone from the dump cars, after which it is lifted to a scalping screen (C) by a 36-inch Power and Mining belt-and-bucket elevator (B). This screen (Traylor Eng. & Mfg. Co.) takes out the marketable sizes, which go to the bins by chuting past the crushers to a short conveyor belt (G) which delivers to the high elevator (H). The rejects over the end of the scalping screen all go into a No. 7 or two No. 6 crushers and the 2-inch and 3-inch stone are conveyed to the high elevator or else are recrushed in the two No. 6.

In the nest of crushers under the scalping screen there are, therefore, five crushers—a No. 7 and two No. 6 Allis-Chalmers (E and D-D) and two No. 5 Austin (F-F). The use of the No. 5's will be explained later. By consulting the diagram it will be noted that the crusher openings are slightly lower than the floor of the room, thus rock can easily be shoveled in in case it overflows onto the floor.

As explained above, the short 30-inch pickup belt (G) under the crushers delivers to the high elevator (H). The latter is of the belt-and-bucket type, 36 inches wide and 76 feet long, made by Chalmers & Williams, Chicago Heights, Ill. This discharges into a 60-inch by 24-foot Traylor all-steel screen (I) with a jacket of ¼-inch wire with 1⅛-inch square openings that scalps the 1-inch and under and puts it onto a conveyor which carries it to a 48-inch by 20-foot Traylor screen also located on the top floor. The 60-inch screen sizes the 1¼, 2 and 3-inch rock and drops in into the bins. The 48-inch screen makes everything from "fertilizer" to 1-inch. Any combination of those sizes, say ⅜, ½ and 1-inch, can be mixed.

Can Feed from Bins to Crushers

There are ten bins of reinforced concrete with hopper bottoms, each holding 200 tons. These are in two rows, five to a row, and deliver to railroad cars which are run directly underneath. An unusual feature is a belt conveyor (J) extending from under the pockets of the north four bins to the two No. 5 crushers. By this arrangement 800 tons of coarse rock can be crushed if and when needed to 1-inch and smaller. After leaving the smaller crushers it returns to the proper bins by the same method as at first employed.

Agricultural Limestone Reserve

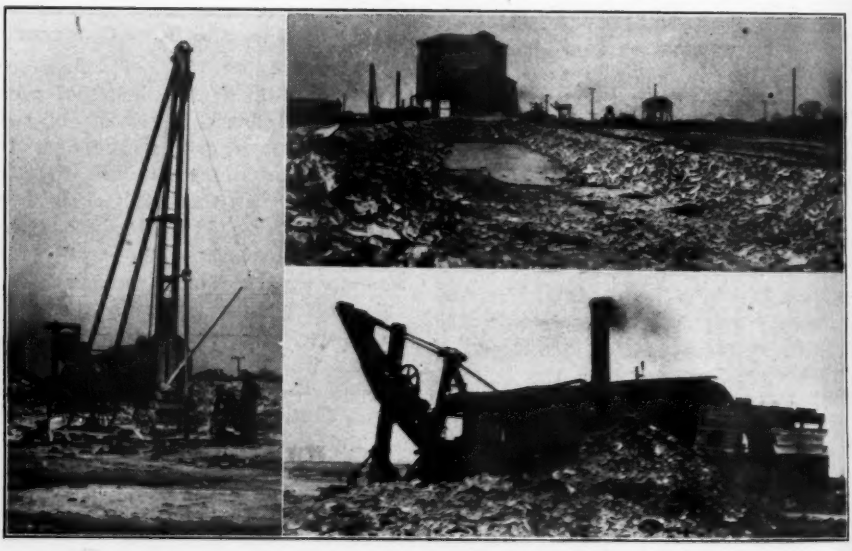
Another unique feature is the possibility of using the contents of the northeast bin, containing 1¼-inch stone, to make pulverized limestone for agricultural purposes. This is ac-

complished by chuting from the bin pocket to a set of 14 by 24-inch Buchanan rolls and a No. 2 Allis-Chalmers pulverator (K) which are set on concrete foundations, though not yet connected up. These will deliver their product to the high elevator and thence through the regular channel, already described, to the fertilizer bins.

Friction clutches control all of the crushers. All motors are of Allis-Chalmers make, stationed as follows: one 200 h.p. for the big crusher and machinery close by; two 100 h.p. for all of the recrushing operations and one 75 h.p. for the big elevator and sizing screens. The plant is electrically operated throughout, current being obtained over a line installed at the stone company's expense. Shipments are made over the New York Central and Illinois Central railroads.

W. R. Sanborn, general manager, designed the plant throughout. In addition to being a practical crushing plant operator he is a civil engineer of considerable experience. The Lehigh company recently operated a large plant about a mile northwest of their present one. This has been abandoned, and it was natural that in the erection of a new plant Mr. Sanborn would incorporate into it his individual ideas born of actual experience, his habit of keeping up to the minute in the matter of efficient operating methods, and a keen insight into future market demands. M. J. Edgeworth, president, is enthusiastic about the mannufacturing possibilities and the commendable quality of the material, and it is a foregone conclusion that the concern will progress in the natural way when efficient management and equipment are brought together.

BUY LIBERTY BONDS



Holes are drilled twelve to fourteen feet deep. Top picture shows straight line of quarry opening, and crushing house in the distance. Shovel in bottom view does both stripping and loading.

Why Stock Pile?

BY R. W. SCHERER
Secretary, Wisconsin Crushed Stone Association, Milwaukee, Wis.

MOST of the advantages of a "stock on hand" in a crushing plant are known to all producers; what is less generally known is the cost of stock-piling and the actual cost of a surplus accumulated during a slack season. A few suggestions along this line may lead to a better understanding — the cost of the material to be stocked, in the first place, confining the discussion to a hand-labor quarry and a crushing plant of 300 to 400 tons daily capacity. The operator of such a plant without a stock-pile finds it necessary to run it to a fraction of its capacity for many weeks in the spring and often in the late fall. A stock pile is contemplated and studied, and "Does it pay?" is the vital question.

The only just comparison is that between the plant without piling facilities and the same plant with them. Without them the machinery is set in motion for 100 tons daily. How much more will it cost to produce an additional 100 or 200 tons? Clearly that is what the material stocked is actually costing and not the average cost of the entire product.

Without going into the detailed analysis of these costs at this time, even an estimate from memory will be fairly accurate. Assuming that the plant is being operated for a small amount of product that can be shipped. To produce 100 tons more to be placed on the stock pile it will take five to seven more men in the quarry, 7 to 10 cents per yard for drilling and blasting, something for wearing parts, but nothing more for superintendence or labor in the crushing plant, very little more for the power plant, not a cent more for the engineer and usually nothing more for transportation from quarry to crusher, and not one cent more for the customary "overhead."

Take your own figures. Of course, every operator knows that if 100 tons per day cost $100 the second 100 tons crushed on the same day cost very much less than that. Let each operator figure up what it will cost and charge this to stock pile. In the size of plant under discussion that figure will be found to be between 30 and 50 cents per ton. In a steam-shovel plant the cost of additional tons is

even less. Then can you afford to pile it?

Bin Storage Too Costly

The cost of piling and reclaiming is the next question. It depends on the quantity to be stocked and the device employed—and there are many possible devices. Generally speaking, the costlier devices, those highest in first cost, are the more cheaply operated. For instance, from bins the loading or reclaiming cost is almost negligible. But the investment in the plant is great and is not warranted unless they are filled and emptied many times during a season. To erect bins of large capacity, even of the cheapest construction, will cost $4 per ton of their contents; that is, a bin holding 1,000 tons will cost at least $4,000. Depreciation on cheap wood bins is large; concrete or steel bins require a still greater investment, so that, leaving cost of operating out of consideration, interest and depreciation alone are not likely to be less than 15 per cent of $4, or 60 cents per year for each yard stored. Clearly, for storing a reserve stock from spring to fall, they are out of the question. Indeed, over-investment in bin capacity has eaten up the profits of more than one plant that should otherwise have succeeded.

In fact, first cost is a large consideration in every stocking-plant. Interest and depreciation on investment, plus operating cost, divided by the number of tons to be handled, will give the cost of handling a ton, and this must be taken into account. Only by taking all these items into account can the equipment be adapted to the required work. It is easy to over-equip such a plant and sometimes difficult to find out afterwards why it does not pay.

Ground storage is of course very much cheaper in first cost than bins, and there are several methods of placing and reclaiming, the most common being a trestle at a high elevation, carrying belt conveyers and a tunnel under the pile also provided with a conveyer for reclaiming. Most commercial plants would be forced to stock four or more sizes at different times, or simultaneously. To avoid the necessity for as many belts as there are sizes of product, it is feasible to provide a single conveyer of ample capacity that reaches all the bins, and can carry each size to its place in the yard, emptying each bin in turn as required. To do this the sizes must be taken from the bottoms or near the bottoms of the bins instead of from the screens or upper spouts. It may be necessary to elevate all material to the trestle, but even that should be found more economical than the upkeep and constant operation of several smaller conveyers.

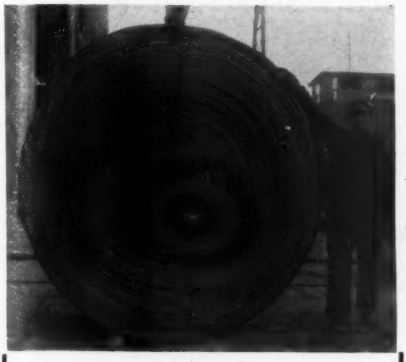
The cost of operating such a system, though necessarily greater than that for bins, is still little enough; the investment is the principal factor, but it will pay when the storage capacity per foot of trestle and tunnel is large enough, and that depends on the height of the trestle if its entire length can be used. If the pile is filled and emptied two or more times in a season, the belt conveyers are probably the cheapest of all devices. Much bin capacity could economically be replaced by this method of ground storage.

Conveying Systems

Another application of the trestle is to carry materials on it by means of one or more dump cars instead of the conveyer belt. Operating such a car by hand in a small plant is not impracticable. Indeed, one man can move a surprising quantity of stone in this way. For larger operations a moving cable and devices for automatically dumping the cars are in successful

use and there is less effect of the elements on cable and cars than on belts, and no need for housing.

Instead of the conveyer belt placed in a tunnel under the stock pile for reclaiming, a self-contained conveyer belt—that is, one that is carried on its own frame along with its motor—can be used either in successive tunnels or it can be placed against any part of the pile on the ground and loaded by a power loader. These should handle better than a ton per minute—a carload in half an hour—and should be adequate in a small plant or where the railroad tracks permit of so much time for loading a car. Even the loading of this belt conveyer by hand is not prohibitive in cost.



Some Belt!

THE PICTURE ABOVE shows a large belt recently furnished by the Gutta Percha and Rubber Manufacturing Company to Dolese & Shepard Company for their Gary, Ind., stone crushing plant. This belt is made in one piece, 665 feet long and 30 inches wide, is 8-ply with a $\frac{3}{16}$-inch rubber cover on one side, and a $\frac{1}{16}$-inch cover on the other. The weight of the belt is approximately 8,000 pounds. It will handle about 1,400 cubic yards of crushed stone per day. This is the third belt that this belt-making concern has furnished to the stone company for this plant. It will be used on an incline 330 feet long, leading from No. 6 crushers to the screening and storing house. The belt was shipped boxed on a flat car and removed by a locomotive crane. A dozen workmen were required to handle it, one of whom is shown standing nearby so as to give an idea of the belt's diameter when rolled. Some belt!

In larger plants where the quantity to be handled annually runs into tens of thousands of tons, the investment in a locomotive crane and clam shell of suitable capacity would be warranted, since the ton-cost of operating is very small. With it the capacity of the stock pile is limited only by the room available for it and the tracks built for the crane.

There is a suitable plan of stock piling for every kind of plant and in no case need the cost of placing and reclaiming exceed 15 cents, and it may be as low as 5 cents per ton. Add this to the cost of the material placed into the stock pile during a dull season, charging to the account of stock-pile only such expenditures as would not have been incurred without it, and stock-pile will show a profit in any quarry.

If conditions are right it is even possible in a hand-labor quarry in normal times to save the expense of piling by the greater economy of producing in spring when, ordinarily, labor is plentiful and a full crew of willing men can be organized. The stock-pile will make for service. Let the demand for crushed stone be supplied with a reasonable degree of promptness and that demand will increase perceptibly.

Besides, it will make a real, a dependable business of a crushing plant. Above all, it will stabilize prices; no need for the owner of a stock-pile to sacrifice on a surplus of one size or

the other, or of his entire product; he can hold them for the height of the season; he can promise shipments and live up to his promises as far as the car supply permits; he is not continually losing customers on account of break-downs, and a strike has less terror for him. He is selling something that he has ready for shipment and not something of which there may be a car to spare on Tuesday and another on some other day; he need not rob Peter to supply Paul.

Agricultural Ground Limestone

BY RICHARD K. MEADE

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LIME and its compounds, when applied to soil, serve two purposes—to correct the acidity of sour soils and to supply the lime which the plant itself needs to properly promote its growth. Lime exists in four forms which are used in agriculture (1) *burnt or quick-lime,* (2) *hydrated lime,* (3) *ground limestone, and* (4) *gypsum or land plaster. Formerly only quick-lime and gypsum were used, but of late hydrated lime and ground limestone are coming into extensive use. On the other hand, gypsum is now seldom used except in localities where it can be obtained cheaply.*

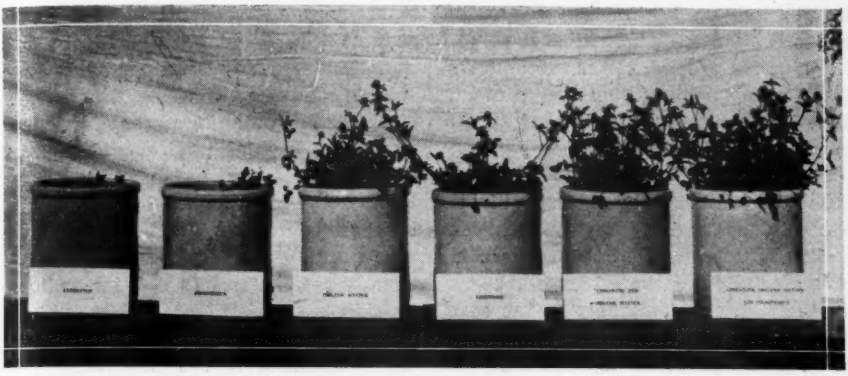
THERE ARE, broadly speaking, two kinds of limestone—high calcium and dolomite (or magnesian). The former, when pure, contains 56 per cent of calcium oxide (commonly called lime), and the latter, when pure, contains 30 per cent calcium oxide and 22 per cent magnesium oxide (or magnesia), the balance in each instance being carbon dioxide. Ordinarily, limestones are never quite pure, containing some sand and clay matter, and the high-calcium stones are never quite free from some magnesia, nor do the dolomites ever contain quite 22 per cent of magnesia, so that many limestones lie in between the figures given for high calcium limestone and dolomite. This can, perhaps, best be illustrated by giving below the analyses of some ground limestones offered for sale in various parts of the country.

ANALYSIS OF GROUND LIMESTONE

Locality—	Impurities*	Calcium Oxide (or lime)	Magnesium Oxide (or magnesia)
Eastern N. Y.	1.80	31.00	21.02
Western Conn.	6.70	48.07	3.43
Southern Penn.	4.15	30.38	20.60
Maryland	3.32	51.10	1.27
Georgia	4.71	52.77	0.82
Maine	3.15	47.72	5.60

*Consisting chiefly of silica, oxide of iron and alumina.

It is generally held that the value of limestone for fertilizer depends upon the percentage of calcium and magnesium oxides which it contains—the more of these present the better. Some authorities contend that only the calcium oxide is of value. The state agricultural authorities in both Maryland and Virginia, for example, do not recognize the magnesium oxide as being of any value and advise that only high-calcium limes should be employed. Prof. Hopkins, however, one of the strongest advocates of ground limestone for fertilizing, contends



POT TEST WITH CLOVER ON WHITE, ACID SOIL, NORTH VERNON FIELD, ILLINOISIAN GLACIATION.

1—Untreated; 2—Phosphate; 3—Chopped Clover; 4—Ground Limestone; 5—Limestone and Clover; 6—Limestone, Clover and Phosphate.

PULVERIZED LIMESTONE will do as much as any one thing to increase the productivity of soils. Of course, we do not recommend it alone, but we always advise that it be used in connection with manure or commercial fertilizer. It should be emphasized very strongly that manure and fertilizer do not take the place of lime in soil and neither does lime take the place of manure and fertilizer, but the farmer who uses pulverized limestone and a reasonable amount of commercial fertilizer, grows legumes in a regular rotation, saves all waste products and manure and returns them to the land, that farmer will build up his soil so that he can produce maximum crops.

—S. D. CONNER,
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that dolomitic limes are of equal value. Those who are thinking of preparing limestone for the agricultural trade from dolomite, therefore, should carefully examine the requirements of the states in which they propose to sell their product, otherwise they may find that the recommendations of the local experiment stations discriminate strongly against their product.

LIME AND LIMESTONE VALUES

A great deal has been written about the relative value of burnt lime and ground limestone. Certain authorities, Prof. Hopkins for example, contend that quick-lime should not be used as it burns up humus (a natural organic fertilizer) in the soil and that ground limestone only should be employed. Other agricultural chemists, and by far the greater number, hold that the relative values between ground limestone and lime, provided the former is of proper fineness, are as the amounts of calcium oxide (or calcium and magnesium oxides), which they contain. Since lime when pure contains 100 per cent of this constituent and limestone only 56 per cent, the ground lime is only 56 per cent as efficient as the burnt lime. Other considerations such as fineness of grinding probably influence this also, so that, generally speaking, certainly twice as much ground lime-

in its value. While the weight of authority seems to hold that the finer the stone is ground, the more valuable it is, many high authorities contend that if the limestone is ground to all pass a No. 10-mesh, it is fine enough, while if ground to nearly all pass a 100-mesh, the loss of limestone from the solid by leaching makes frequent additions necessary. The preparation of material finer than 10-mesh, these contend, adds considerably to the cost of the product and, since the chief aim of ground limestone is to supply a *cheap* form of lime, anything which adds to the cost is undesirable. Certainly most of the agricultural ground lime offered for sale is not finer than 10-mesh product and some of it is even much coarser than this.

The following sieve analysis will give an idea of the relative fineness of the two products.

Passing Standard	No. 1	No. 2
10-mesh Sieve	100	100
20-mesh Sieve	88	100
50-mesh Sieve	70	99
100-mesh Sieve	40	95
200-mesh Sieve	32	82

Legal Requirements As to Sale

Nearly all states have certain laws regarding the sale of fertilizers under which head ground limestone would come. Usually these laws require the registering with the state agricultural department of the name of the brand, that of the maker and address and his guarantees as to purity, percentage of calcium oxide (or in some states calcium and magnesium oxide) and the fineness to which it is ground. Certain fees are usually to be paid upon registering. These acts also require that the bags in which the product is sold shall be marked or tagged with the above information and also give the weight of material in these. If sold in bulk, there must be a placard in the car giving all this. These laws require not only the local manufacturerer to register his brand and follow these rules, but require this of all who sell lime within the state. Thus a manufacturer of ground limestone in Maryland would be required to register, not only in Maryland, but also if he sold his product in these states, in Virginia, Pennsylvania and West Virginia. There are usually penalities imposed for selling lime in states without registering or complying with the terms of the act, and sometimes if the lime does not meet the guarantees as to quality the manufacturer must pay a fine to the state and sometimes a penalty to the purchaser.

The process of registering, however, is simple and blanks are furnished by the agricultural departments of the various states for this purpose. The fees are small, usually $10.00 or $15.00, but must be paid each year. An occasional analysis costing $5.00 to $8.00 will usually be sufficient to ascertain that the product meets the guarantee as to purity and fineness. The bags may have the brand name, manufacturer, net weight, guarantee, etc., printed, stamped or stencilled on them or a tag may be fastened to them giving this information.

Determining the Quality of the Stone

The first step of the quarryman who desires to furnish agricultural ground limestone should be to determine the quality his product would have. Those who are furnishing fluxing stone to blast furnaces are, of course, acquainted with the quality of their stone, but usually the man who is supplying crushed stone for road and concrete purposes knows very little about the chemical quality of this material, as his trade has been only interested in its hardness, etc.

The proper way to determine the

stone must be employed as lime.

Fineness of Grinding

The fineness to which the limestone is ground is also an important factor suitableness of the limestone for fertilizer is, of course, to have analyses made. The samples sent to the chemist should be representative of the various beds or ledges of the quarry. Operators often have some idea as to the composition of the various ledges they are using and hence can themselves pick out the purest ledges.

How to Take Samples.

In taking samples, it is better to select a half dozen or more pieces of stone the size of the first from each ledge and combine in one sample rather than to select just one piece, no matter how large, as a representative sample of the ledge. In most limestone quarries, the beds are distinct and are separated from each other by well defined partitions so that when they are once established and their purity ascertained the experienced quarryman can tell pretty well how his product will run.

If the ground limestone business is an adjunct to the road material business, the purer ledges may be employed for ground limestone and the impure ledges for crushed stone for roadwork, concrete, ballast, etc. Where limestone is quarried only for agricultural purposes, care must be taken to see that the pure stone can be gotten out as wanted. For this reason the combination of stone crusher and grinding mill is desirable as should beds of impure limestone lie on top so as to interfere with the taking out of the pure stone, the former can be taken off and crushed for road metal, etc., exposing the good stone for later development; or, when the pure and impure beds are interstratified, they can often be quarried at the same time, separated by hand or by working in benches, and the pure limestone used for fertilizer and the impure rock for crushed stone. Of course the ideal situation is to have all the beds pure enough to be employed for agricultural purposes.

After ascertaining the composition of the stone, the remarks made at the beginning of the article will indicate the value of the limestone for fertilizer. The intended operator should also get in touch with the state authorities and ascertain their requirements and views. It should be said, however, that what constitutes a good agricultural limestone will depend largely on the locality in which it is to be used, as the limestones found in some sections of the country are much purer than those found in others. Generally speaking, any limestone containing 98 per cent carbonate of lime (or when the states recognize the latter, 98 per cent of combined carbonate of lime and magnesia), may be considered as a very high-grade material. Limestone containing 95 per cent carbonate of lime (or combined carbonates, if recognized) will always be found acceptable and in many localities stone running as low as 90 per cent carbonate of lime (or when allowed combined carbonates) is sold readily.

The guarantee as to quality should be based on the analyses of the various ledges. No doubt the chemist making these analyses will be glad to advise as to the proper guarantees which can be made. It is, of course, always of advantage as a sales point to make the guarantee as large as possible.

(Continued in the June issue.)

Gravel should not be placed on a road that is rough and uneven. The surface to be gravelled should be smooth, without ruts and pot holes. Gravel placed on a poor surface or a poor grade can never give the results that it can with the road in proper condition for gravelling.

EDITORIAL

Pit and Quarry

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Agricultural Limestone

TO THE QUARRYMAN who is getting out limestone, the question of the preparation of agricultural ground limestone is of interest because it is a natural step for him to branch out into this industry when the demand for this product reaches his community. Since the value of ground limestone is not great, it is necessary that it shall be supplied from local sources, otherwise the freight rate will add so much to its cost to the farmer that he might decide to purchase quick-lime, owing to the fact that so much less of the latter need by employed to fertilize a given tract. Ground limestone will stand a reasonable haul by rail, but not several hundred miles.

In most agricultural districts, particularly where grain is grown or where cow-peas and clover are used for soil enrichment, it should pay the quarryman who has a fairly pure limestone to draw on to put in a grinding plant and educate the farmers to the benefits of employing ground limestone on their land, particularly where there is no local competition in this industry. In this work, the quarryman will be ably assisted by the agricultural experiment station of his state, particularly if his product meets with the approval of this as to quality.

Riding the Bumps of the War News

DO YOU RIDE all the bumps of the war news from day to day? Many good patriots do. Each morning brings its passing changes in the war situation; now gloom, in the form of a setback on the western front, or further disintegration in Russia, or rumors of delay in our own war preparations. Next morning, like as not, there will be something of a hopeful nature, such as the checking of the Huns' drive in Italy, or a raid by the British or French, or good news here at home.

To follow and feel all these glees and glooms from day to day is human and exciting. But it involves much useless wear and tear of the spirit.

There is another viewpoint—that of disregarding the daily shifts and changes in the war situation, keeping one's attention concentrated on the long haul of war and the final result. If you grow warm and then cold, and alternate between enthusiasm and depression with the daily news

changes, you not only waste your energy, but are likely to fluctuate in your policy as a business man and your determination as a patriot.

It is good business, good patriotism, and good conservation to forget most of the headlines in the morning paper and concentrate strictly upon the long, hard grind between today and the final result. That will save your spirit, buck up your resolution, and enable you to do your utmost in winning the war. Settle down in harness for the long, grim haul that counts!

Methods of Working Pits

Describes Various Ways of Taking Material from Sand and Gravel Pits by Excavating from on the Top

One general method of working any kind of a pit is from on top. For this there are various kinds of tools and machinery that can be used, and their selection must depend upon the extent of the operation and, in some cases, with the lay of the land, or rather the pit with reference to the washing machinery or the shipping bins. The simplest method is by hand, when carts, wagons or cars are loaded by men with shovels. For limited operations and especially in new pits, one-horse dump carts are loaded by men. This cart can be loaded as cheaply as either a car or a wagon and can be dumped with great ease, but due to its small load of seldom more than three quarters of a cubic yard and often less, the cost of transporting is high. For this reason such carts should not be used even to start work. Dump wagons are much cheaper than such carts, while cars of one-cubic yard capacity or more are cheaper than the wagons.

BY D. J. HAUER, C. E.

WHILE THE ABOVE methods can be used in excavating from on top, yet the hand loading is too expensive either for working pits by this method or against a breast, and for a small operation it is possible to use teams, yet cart out the hand shoveling. For this scrapers can be used. There are four kinds of scrapers for this work. The ordinary drag or slip scoops, the Fresno scrapers, the two-wheeled scrapers and the four-wheeled scrapers. For all of these horses or mules are used, and in some

cases the material may have to be loosened by plows or other means, but for most sand and gravel pits this is not necessary. The limit of haul by the first two is limited to about 100 feet. When the hauls are longer these scrapers can be used to load wagons or cars, and the longer hauls made with these.

This loading can be done in several ways. The scraper can be dumped through a trap directly into wagons or cars. A platform can be built over a pit, into which the wagons or cars can be run and the trap in the platform takes care of the load. The objection to this is that the wagons or cars are in a hole, either limiting the load or using extra power to pull out from under the platform. For this reason the platforms are usually built above the ground, high enough for the cars or wagons to pass under them, and the loaded scrapers are carried up an inclined runway to the trap in the platform. This does not materially affect the load of the scraper.

This method is much cheaper than loading wagons and cars by hand but the objection to it is that the scraper teams cannot always be kept busy because of a lack of wagons or cars. The loss of time for teams could easily make the loading more expensive than hand work. In some few cases this can be overcome by having an extra lot of wagons or cars on hand, but this, too, can prove very expensive.

Loading Bins Keep Teams Busy

The best method of keeping the scraper teams busy is to have a set of loading bins. The arrangement is simple. Under the trap in the platform is built a fair sized pocket or boot. The material is carried from this boot by some type of conveyor and elevated to the bins, thus keeping the bins full, and the wagons and cars are loaded from these quickly by gravity. It can be seen that the bins can be located some distance from the dumping platform if long conveyors are used to transport the material to the bins.

One objection to this general method is the limited economical haul of the drag or Fresno scrapers. This can be overcome in two ways. As the sand or gravel is cleaned up over an area that can be about 200 feet square, the platform can be moved or else the conveyor can be lengthened so as to allow other traps being built over it. If only a short conveyor is used, then the bins must be moved and the entire apparatus set up anew. When this is done the bins are built to be portable, and thus moved at small cost. If railroad cars are loaded from the bins they must be so large that they cannot readily be made portable, nor is it possible, even if the bins could be moved, to always move the railroad tracks, so that to such bins long conveyors should be placed and a number of dumping platforms and traps built over them. At long intervals these conveyors and platforms must be moved.

Limit of Haul

Even these need not be moved very often, if after the limit of haul of the drag or Fresno scrapers is reached two-wheeled and four-wheeled scrapers are used. The limit of haul of these scrapers is from 600 to 1,000 feet. The four-wheeled scrapers could be used for a longer haul, but it would mean to purchase so many additional machines that the capital investment would be too large, and the conveyors and platforms could be moved for less money.

With these scrapers it is also possible to have a short conveyor or elevator and haul the sand or gravel in the wheeled scrapers. Thus an area of about 1,600 feet long and about 800 feet wide could be excavated with four-wheeled or Maney scrapers. This means nearly three acres of land. It is not only practical to use all four types of

scrapers for excavating sand and gravel, but also for stripping sand and gravel pits.

It can be seen that as soon as a pit operation becomes extensive enough to demand the use of a large number of scrapers, conveyors, horses and men, such an operation becomes too expensive, for it means the investment of considerable capital in scrapers, conveyors and horses, and a constant ex- large payroll for teamsters. Then, too, the capacity of the plant is limited by that of the conveyors.

Power Scrapers and Slack Cableways

pense of feeding horses and a fairly

For less than the investment and operating expenses another system of excavating and transporting can be installed. This is a power scraper and slack cableway. These are operated by a hoisting engine but are inexpensive to install and are operated at a small cost. Their range of work is large. Thus with a single machine with a cableway 800 or 900 feet in length, excavation can be made over an area of about three acres. The mast at the bin can be set up permanently, while a pulley or sheave at the other end of the cableway can run on a cable stretched between two dead men or anchors. Thus the cableway can be moved easily over a considerable area without changing the dead man, a decided advantage.

These power scrapers are of varying sizes, and can be equipped with teeth for hard digging. They, too, can be used for stripping, and one great advantage they possess over most other excavating machines is that they can dig to almost any depth under water. Thus in pits they carry on the excavation without pumping, and they can also be used for excavating sand from streams and rivers that are not too wide for the slack cableway. During the past ten years there has been developed a very wide field of usefulness, especially in the sand industry, for these power scrapers or excavators.

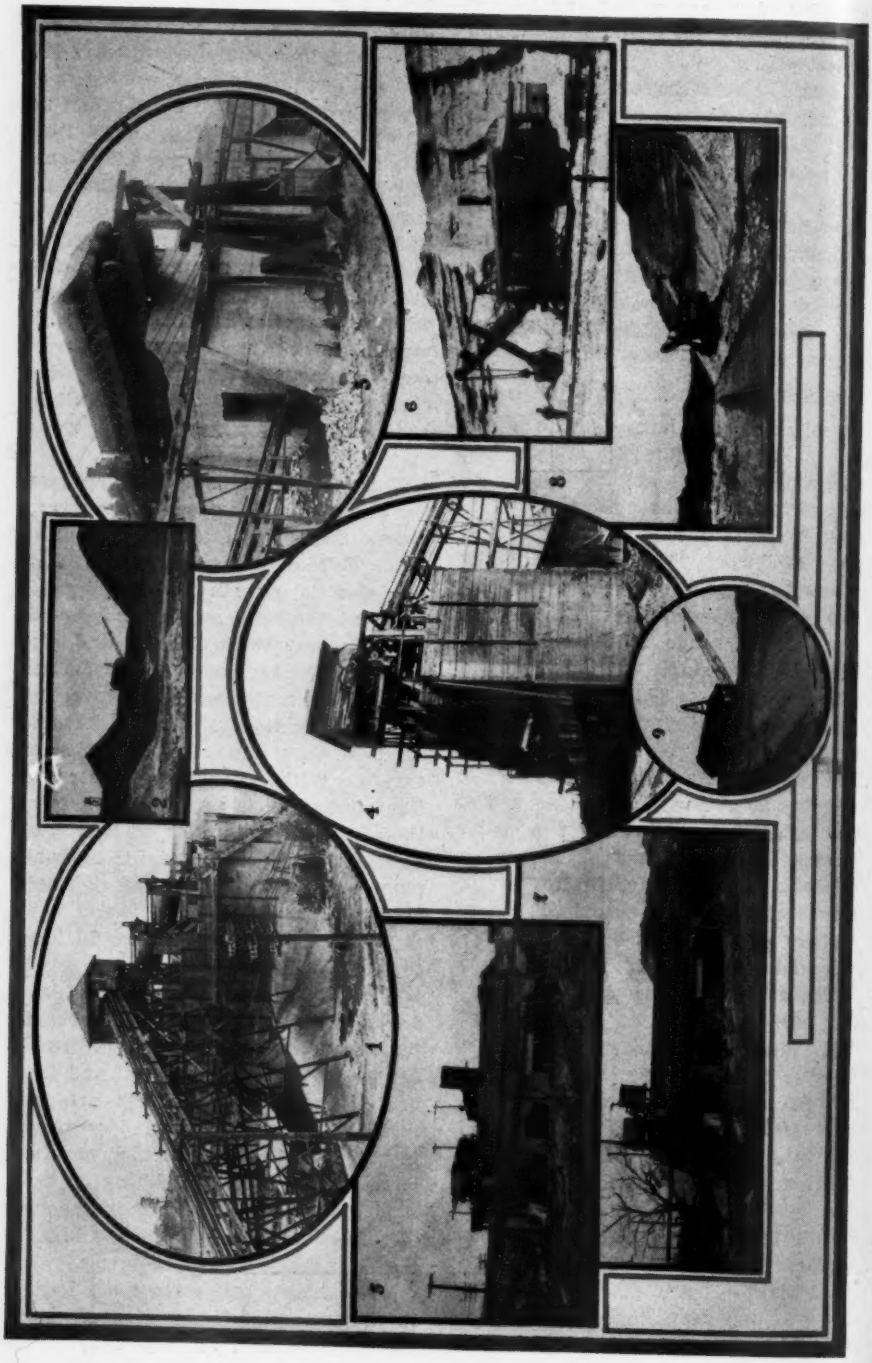
The only disadvantage to them is the fact that, operating on a cableway, at least one-half of the time is taken up with the scraper traveling empty, thus only one-half or a little more than one-half of the time is used in loading and traveling with the load, the rest being consumed by dumping and the return trip. This limits the digging capacity, but inasmuch as they are operated with very few men at a low cost, it would be possible to install two scrapers dumping into the same bin, and operate the two with only a slight additional cost. This would give a very large output each day.

There has recently been placed on the market a double scraper cableway system for exacavating and handling sand. While one scraper is loading the other is dumping, thus doing the work of the two, as here suggested. Similar scrapers or buckets and also grab buckets, such as orange peels and clam shells, can be used for excavating pits from on top. These are operated on cableways, traveling derricks or cranes. With a cableway, transportation equipment is not needed, but for the others either cars or wagons must be loaded and the material thus transported. If this is not done an elaborate system of conveyors that would have to be changed frequently would have to be installed.

It is this transportation that is a drawback to these scrapers and buckets for excavation. If wagons or trucks are loaded directly in the pit and then hauled away these buckets are economical, but where the sand or gravel must be washed or screened, or must be stored in bins for loading on railroad cars, then the cost of transportation from the excavator to the bins is the item that prevents their use.

When trucks and wagons are loaded in the pit and delivery of sand made

(Continued on page 212)



Big Gravel Crushed and Screened Dry

Explanation of Pictures on Opposite Page.

1. Washing and screening plant of Reinert Brothers at Algonquin, Ill. 2. Dragline which does the stripping. 3. Bottom-dump ballast car depositing its contents into concrete hopper, underneath which is a screen. 4. Same as Fig. 1, showing the loading spouts. 5. Two Symons disc crushers are in this building, which adjoins the concrete hopper shown in Fig. 3. The material is conveyed back to and again run through the screen previously mentioned, after which it is taken up the incline to the washer. 6. Steam shovel which loads the ballast car shown in Fig. 3. The gravel bank has a face forty feet high. 7. Another view of the crusher building shown in Fig. 5. 8. General view of the gravel deposit and track system. 9. Close-up picture of the dragline shown in Fig. 2.

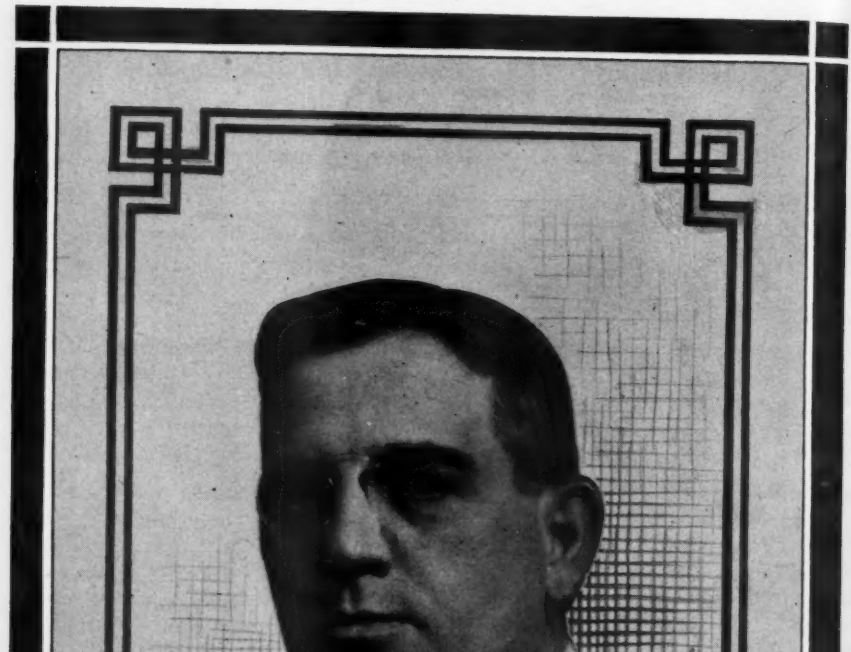
BIG GRAVEL is crushed dry at the plant of Reinert Brothers, about a mile and a half northwest of Algonquin, Ill., on the C. & N. W. railroad. This crushing is done at the foot of the incline, where there is a screen which separates the larger stones from the 1¼-inch and smaller, which are suitable to go direct to the washing house and its screens.

The locality is notable for the quantity and quality of the gravel of which the numerous hills are composed. At the Reinert plant, after stripping with a Monighan drag line machine, the gravel is picked up by a Marion Model 60 steam shovel with a 2½-yard bucket and loaded into an 80,000-pounds capacity dump-bottom Rogers ballast car, pulled by a standard-gauge, six-drive switcher. There is only one car and one locomotive, but the time consumed in hauling is not great. The digging has been done in straight lines which have a common starting place near the dumping point; in other words, when one bank is excavated the full length of the property, the track is moved a short distance to one side.

The material is dumped from the car into the concrete hopper shown in the picture, underneath which is a Dull conical screen. The gravel passing it goes up the incline as mentioned, and the big stones are conveyed to two No. 36 Symons disc crushers operating in the building shown at the right of the concrete hopper. Inasmuch as a considerable quantity of the material is big stuff, these crushers are kept busy.

After being crushed the material is returned to the screen under the hopper and, added to that which is passing through direct from the hopper, it is taken up a 150-foot incline to the top of the washing plant. The belt is 30 inches wide, of the Rexall (Imperial Belting Company, Chicago) type. It has been in steady service more than three years and is expected to last about four more seasons. Here it is deposited in a small hopper and then goes to a double row of Dull conical screens, shown in one of the pictures, which make five different grades, No. 8 (1½ to 3-inch), No. 9 (¾ to 1½-inch), No. 5 (⅜-inch), No. 2 (torpedo), and No. 7.

From the screens the material goes to seven bins which load railroad cars through spouts at the bottom. The output is 65 carloads a day. The plant is operated by electricity. There are four motors—two 50-h. p. for the disc crushers, one 50-h. p. for operating the plant, and a 30-h. p. is used for the pump. The company has been operating since the fall of 1911. John J. Reinert is president and his son, F. M. Reinert, is manager of operations.


J. M. WILLIAMS
LIMA, OHIO

The Highway and Its Relation to Transportation

BY S. M. WILLIAMS

President, Highway Industries Association; General Sales Manager, Garford Motor Truck Co.

AT NO TIME in the history of the United States has there been any question of such vital importance, to all industry, as that which transportation occupies today. No one will dispute the statement that there is no greater influence for the progress of any country than the building of good roads. Official Washington has for many years closed both eyes and ears to the public highway, and it is time that our National Government should assume its own responsibility in highway development and build certain classes of roads without obligating states and counties.

THE heavy rush of war materials and supplies, together with the movement of large numbers of troops, all of which must have precedence over all other classes of materials, has caused terrific congestion around terminals of all the railroads, with which the railroads themselves now admit they are absolutely unable to cope. The situation is so serious that railroads in nearly every section of the country are begging for relief by outside means of transportation and our own government officials are now and have been seriously considering where and how passenger travel may be curtailed so that wherever possible the entire railroad trackage of our country may be used for the carrying of freight.

Two other solutions toward assisting the railroads in handling the enormous amount of freight have also been offered, and should be given serious consideration at the present time. These are, (1) the utilization of waterways. This plan, if properly organized, will be certain to give considerable relief, but the principal objection to its extended success is the important fact that such waterways are limited; (2) the utilization of the highways for the delivery of freight to and from congested terminal cities. Many of these roads have been improved, but they have not been built for the unusual strain that will be placed on them if large numbers of heavy motor trucks are started out over them on regular routes. Heavier foundations and higher types of roads than those generally constructed in the past will be absolutely necessary if our roads are to be used for the transportation of large quantities of freight.

Already motor truck traffic in the vicinity of our principal cities has increased at such enormous rate, within the past six months, that great damage has been and is being done. No one can really be blamed for this condition, as it was impossible to foresee only a few years ago when the roads were built what a sudden increase there would be.

Comparative Delivery Costs

Motor trucks have been used for several years in the larger cities for hauling freight between the respective cities and smaller towns within a radius of 50 miles, and even more in some few cases, and the move has been a success in almost every case with which I am familiar. There are many cases in which the hauling costs by motor truck between given points are considerably reduced as compared with railroad freight handling costs and drayage charges at both ends.

But even if the actual charge for hauling between two points 50 miles, we will say, distant from each other was slightly more by motor truck than by railroad, there are other advantages to be taken into consideration, all of which reflect to the credit of the motor truck. There can be no demurrage charges, for instance, and a material saving in almost any line of business can therefore be effected. In every known instance where the motor truck is operating in highway transportations, shipments are continually being

delivered between the terminals in much less time by motor truck than by rail.

Another, and a very important, advantage in favor of the motor truck and one that instantly appeals to manufacturers in general, is the fact that shipments can go out to nearby points at much more frequent intervals where the trucks are used, as it is not necessary to wait until a full carload is ready before making the shipment.

WHERE ROUTES ARE ESTABLISHED

Many regular lines of freight-carrying motor trucks are now operating from Boston, Hartford, New York, Albany, Trenton, Philadelphia, Atlantic City, Baltimore, Wilmington, Washington, Cleveland, Detroit, Chicago, Pittsburgh, Los Angeles, San Francisco, Portland, Seattle and other cities. The longest line operating on a regular schedule at the present time is one between Akron, Ohio, and Boston, Mass., trucks starting out from both terminals daily and running via Beaver Falls, Pittsburgh, Greensburg, Bedford, Chambersburg, Gettysburg, Lancaster, Philadelphia, Trenton, New York City, Bridgeport and Hartford, Conn., Springfield, Worcester and Boston, Mass. This line operates seven days a week and each truck makes the round trip of about 1,500 miles in less than a week.

Successful lines are also operating between Philadelphia and Atlantic City, a distance of 60 miles; between Philadelphia and Trenton, 30 miles; between Philadelphia and Baltimore, 100 miles; between Philadelphia and Harrisburg, 100 miles; between Baltimore and Washington, 40 miles; New York to Trenton, 60 miles; New York to Philadelphia, 90 miles; Chicago to Gary, Ind., 25 miles; Chicago to Elkhart, Ind., 110 miles; Chicago to Rockford, Ill., 95 miles, and between Boston and scores of manufacturing cities within a radius of 50 miles and more.

ROADS MUST BE IMPROVED

These motor truck freight lines, as well as scores of others in different parts of the country, have thoroughly demonstrated the importance of highway transportation and that when operated upon properly constructed roads the service is both economical and dependable. The actual running of these lines has proven beyond all doubt, however, that more attention must be paid to the improvement of roads over which such lines may be expected to run in the future.

Highway transportation by means of the motor truck is today only in its infancy, although it has positively passed the experimental stage, and the use of these vehicles will increase very materially during the coming years.

Methods of Working Pits.

(Continued from page 207)

direct, this means that an elevating grader, propelled by some type of traction engine, can be used, and for a fair daily yardage will prove economical. Such a machine can excavate from 500 to 1,000 cubic yards in 10 hours under favorable conditions, so that these machines should not be installed for small outputs.

For limited outputs from pits when wagons or trucks are used for direct delivery and there are not bins to use, an Albrecht excavator can be used for loading. This machine operates a scraper, which dumps by a chute into a wagon. By means of a wire rope an area about 75 feet long can be worked over at one time.

These are the principal methods of working pits from on top. In another article the methods of working pits aganist a breast will be discussed.

Drag Gravel Roads Now.

SPRING WEATHER is always severe on gravel roads. In some states traffic is prohibited over them until the amount of water in the ground is lessened, if any type of vehicle will cause deep ruts. If the road has enough clay in it to compact it during other seasons, it is made all the muddier during the period of breaking from winter to spring. Frank W. Rogers, Michigan State Highway Commissioner, advises the dragging of all roads until the middle of May or the first of June.

ASSOCIATION ACTIVITIES

Ohio Gravel Producers Organize

OHIO SAND AND GRAVEL producers have concluded that it is now the time to be represented by a state association, and accordingly met in Columbus, April 3, and formed the Ohio Sand and Gravel Producers' Association. It did not take long to get down to business. Officers were elected and a constitution adopted. One instance of the way the association means to get into action was the immediate selection of an executive secretary who will devote a great part, possibly all, of his time to promoting the industry. Upon all occasions he is to be the spokesman of the organization.

Following is the officers' list:

President, F. D. Coppock, president of the Greenville Gravel Company, Greenville.

Vice president, R. E. Do Ville, Lake Sand and Gravel Company, Toledo.

Secretary-treasurer, E. S. Warner, Akron Gravel and Sand Company, Akron.

Executive committee, E. A. Evans, Zanesville Washed Sand and Gravel Company, Zanesville; J. T. Adams, Concrete Materials Company, Columbus; J. M. Truby, Peele Island Sand and Gravel Company, Cleveland, and Frank J. Teejan, Wiggam Crushed Stone and Sand Company, Germantown.

Guy C. Baker, of the Greenville Gravel Company, was appointed as the executive secretary at an annual salary plus expenses. He will confer with the other officers and plan the activities of the association.

The following producers were represented at the meeting:

SAND AND GRAVEL FIRMS REPRESENTED

The Akron Sand & Gravel Co., Akron.
Barnes Sand & Gravel Co., Piketon.
Builders Sand Co., Cleveland.
Chagrin Sand & Gravel Co., Cleveland.
Chillicothe Sand & Gravel Co., Chillicothe.
Concrete Materials Co., Columbus.
The Dayton Sand & Gravel Co., Dayton.
Lake Sand & Gravel Co., Toledo.
East Liverpool Sand Co., East Liverpool.
Glacial Sand & Gravel Co., Columbus.
The Greenville Gravel Co., Greenville.
T. J. Hall Sand & Gravel Co., Cincinnati.
The Island Sand & Gravel Co., Columbus.
The Island Washed Sand & Gravel Co., Cincinnati.
Kelly Sand & Transport Co., Sandusky.
Lake Erie Sand Co., Sandusky.
Lorain Sand Co., Lorain.
The Marietta Sand & Gravel Co., Marietta.
The Miami Sand & Gravel Co., Cincinnati.
Mt. Calvary Sand & Gravel Co., Columbus.
The O. C. Barber Concrete Co., Barberton.
Ohio & Michigan Sand & Gravel Co., Toledo.
Ohio Sand & Gravel Co., Columbus.
The Peele Island Sand & Gravel Co., Toledo.
Shoemaker Automatic Sand, Gravel & Coal Elevator, Newcomersville.
Tarco Construction Co., Cincinnati.
Tecumseh Sand & Gravel Co., Tecumseh.
Wiggam Crushed Stone & Sand Co., Germantown.
The Wiley Construction Co., Cincinnati.
Zanesville Washed Gravel & Sand Co., Zanesville.

Association Advantages.

By G. J. Wilder

Secretary, Agricultural Lime and Limestone Assn., Columbus, O.

THIS YEAR will, no doubt, offer many opportunities to those who know the value of co-operative work. In fact, these are the days of co-ordination; not only does this pertain to the railroads but to all industrial undertakings, for co-operative methods are efficient. They awaken business men to the necessity of the future by the education received.

We are constantly undergoing economic changes, and in order to prepare for that which is to follow we must have organization for our industrial welfare. Belonging to or supporting

an association seems to be the new principle of business.

The character of products for sale is made better by standardization. Bad trade practices are eliminated by the interchange of ideas and the problems effecting a given business can be worked out to better advantage, for these are the days of supreme unselfishness.

Associations help to build up the communities in which they arise. They can accomplish more good as a collective body than any given class of individuals.

The world's business is founded upon co-ordination. Get behind a real organization and build it up, improve methods and take advantage of the opportunities within your grasp.

Indiana S. & G. Holds Meeting

INDIANA sand and gravel producers. members of the Indiana Sand and Gravel Producers' Association, met in Indianapolis a few days ago for the purpose of discussing several issues pertaining to conditions brought about by the war. It is certain that the coming year's business will be under normal, but in order to keep better informed on the rapid changes in the order of things the association felt the need of making the organiation more compact.

One of the decisions made was the necessity of an executive secretary who will devote all of his time to the work of the association. Several subjects were discussed. Regarding the 15 per cent advance in freight rates, the members felt that it was generally acceptable, although they believed that it should apply to intrastate as well as interstate commerce. The ton-mile basis of charging freight was not favored because of the higher rates some of the plants would have to pay because of their greater distance from the markets.

The Compensation Insurance committee advised against forming an association insurance department at the present time, believing it better to wait until its payroll reached one million dollars a year. It is about half that sum at the present time. The members, however, voted to accept the plan of the Indiana Employers' Reciprocal Insurance Association, which has brought about a decrease in rates of about 50 per cent and shown a profit of above 25 per cent.

Another interesting subject was plant depletion, and it was thought that 10 per cent was a reasonable figure.

The members desired to join the National Crushed Stone Association and will ask the parent body to fix a lump sum rate.

The Indiana association is only four years old, but has been very active and has accomplished a great deal. This has been largely due to the efforts of President George V. Miller, who has had full co-operation from all of the members. More than 80 per cent of the gravel produced in the state is represented and a revenue of $10,000 to $15,000 is derived from the assessment of one-half of one cent a ton.

E. Guy Sutton, general manager of the Carmichael Gravel Company, Williamsport, was chosen as secretary. He is at present secretary of the National Association of Sand and Gravel Producers, but in giving his entire time to the state association he may eventually find it necessary to relinquish his duties in the parent body. Mr. Sutton is especially well informed on costs and promotion work.

H. D. CONKEY, MENDOTA, ILL.

H. D. CONKEY, president of the Illinois Association of Sand and Gravel Producers, has a remarkable administrative capacity and several other admirable qualities besides. For one thing, he operates three gravel washing plants and still retains the sunny temperament with which he first entered the business world. His accomplishments are a splendid example of the wisdom of staying at home taking advantage of home opportunities. He did not think it necessary to go away to the big city to find something to do. If the coal, wholesale brick, fireproofing, tile, concrete steel, metal specialties and building material businesses, the turning out of 2,000 tons of sand and gravel a day and operating a thousand-acre farm are not enough to keep one busy, there are still a few things left and no doubt Mr. Conkey will seek them out if he thinks it necessary in order to have something to occupy his time and mind. Under the firm name of H. D. Conkey and Company the concern operates gravel washing plants at Yorkville, Oregon and Moronts, Ill. Mr. Conkey is practically sole owner of these. He is deeply interested in association work in both the Illinois and National organizations.

A. P. Sandles Chosen National Secretary.

AT THE CALL of President A. J. Blair, the Executive committee of the National Crushed Stone Association met at the La Salle Hotel in Chicago, Tuesday, April 9, one of the purposes being the selection of a permanent secretary. Those present were: President A. J. Blair, of Milwaukee, Wis.; John Rice, of Easton, Pa.; L. H. Hawblitz, of Toledo, O., and A. J. Sullivan, of Chicago, Ill. There was a very interesting discussion of conditions which obtain in the crushed stone industry at the present time.

A. P. Sandles, of Columbus, O., secretary of the Ohio Macadam Association, was chosen as the National executive secretary and will perform the secretarial work of both associations, assisted by such office help as is deemed necessary. He entered immediately upon his duties and will keep in close touch with the secretaries of state and district associations and issue bulletins from time to time giving information of interest. One of his chief duties will be that of keeping in touch with Official Washington so as to present before the proper authorities the situation in the stone industry when such information is desired or necessary.

One move to be made will be the possibility of having the crushed stone industry represented on the National War Industries Board at Washington, D. C. Mr. Sandles will keep in touch with Director General McAdoo's department to advise the quarrymen of the probability of embargoes or priority orders being issued. On the motion of Mr. Rice, the National association will apply for membership in the United States Chamber of Commerce. Mr. Rice stated that several Eastern quarry-

men desired membership in the National association and would soon send in signed applications.

Mr. Sandles has the good will of every member, nearly all of whom he has personally met. He has done creditable work for the Ohio association and will couple the experience so gained with his natural energy and organizing ability.

A. P. SANDLES

Secretary National Crushed Stone Association, Columbus, O.

Get into Line.

BY W. R. WEBSTER

Secretary-Treasurer Iowa Sand and Gravel Producers' Association; Director, National Association of Sand and Gravel Producers.

Every sand and gravel producer should belong to his state association and the National association. There are no sufficient reasons why he should not be, and every good reason why he should be, a member.

The Federal government, state legislatures and railway commissions have indicated that industries must be organized to obtain a proper hearing of any case in question. Facts available to associations are not available to individuals and a very few men of an association can represent efficiently all its members. The good fellowship and friendly relationship engendered are worth far more than the actual fees.

Present conditions demand that every producer get into line at once.

Ohio Macadam Magazine.

THE OHIO MACADAM Association issued its first magazine "Macadam Service" in March. It is gotten up in attractive form and is full of helpful little articles dealing with the promotion of the use of crushed stone.

Dolese & Shepard Plant.

(Continued from page 192)

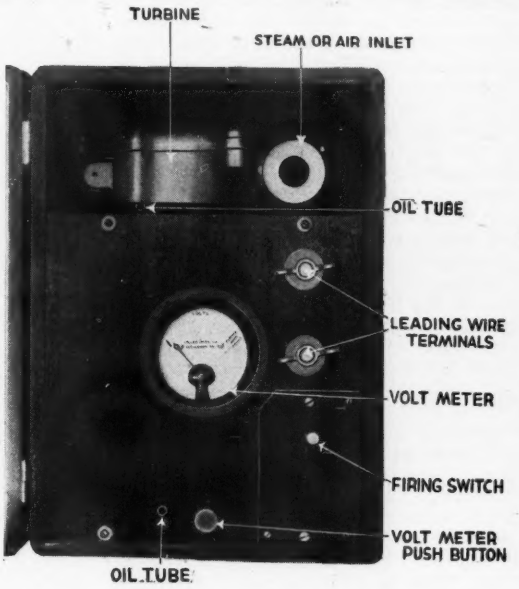
in the general view. This material is sold for agricultural purposes and is loaded into cars by an Industrial Iron Works locomotive crane. There is an elaborate and well kept sub-station housing the motor generator sets and switchboard. A complete equipment of measuring and recording instruments indicates the power required in different branches of the work. Electric current is obtained by a transmission line from the Public Service Company. All motors were furnished by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

The company maintains general offices at 108 South La Salle street, Chicago, Ill., and at the time the plant was built it was the largest producer of crushed stone in the world. J. F. Talbot is president, J. J. Sullivan is vice-president and general manager, and G. R. Thomson is secretary of the company; G. T. Chambers is superintendent of the plant. Shipments are made over various railroads by means of their connection with the Chicago & Illinois Western Railroad, which reaches the plant.

MEN AND MACHINERY

New Electric Blast Firer.

LARGE QUARRIES will be interested in the apparatus pictured here, for generating electric current for detonating high explosives, of a sufficient capacity to fire a large number of charges and eliminate the danger of misfires. The Mason turbine blasting machine was invented by William H. Mason, of the Edison Laboratories, Orange, N. J. It consists of an electric generator connected on a direct shaft with a turbine motor, which utilizes for its motive power either steam or compressed air. Eighty pounds pressure (air or steam) is required to drive it. At full speed it will generate a current of 300 volts and 10 amperes.



The working parts are all incased in a hardwood box, the top of which serves as an instrument board on which is mounted the push button, voltmeter, etc., and is protected by a hinged cover.

The method of operation follows: The leading wires are attached to the binding posts and the steam or air is turned on. The gradually increasing speed of the turbine in turn builds up the electric current of the generator. When the turbine has reached its maximum speed, which requires but a few seconds, the voltmeter push-button is depressed and the indicator moves to the "firing point." The voltmeter push-button is still held down while the main switch button is pressed; and at that instant the blast is fired.

The Mason turbine has a large capacity; it will fire up to and including 150 30-foot copper wire electric fuzes or blasting caps, connected in series, when operated at full speed.

The size (14½x13x10¾) and weight (only 42 pounds) permit the machine to be easily moved from one place to another, thus increasing its usefulness. Oil tubes are conveniently located on the top of the case, making lubrication easy. On the side of the box is a corrugated iron extension pipe, which provides an outlet for the exhaust steam or air. The machine is marketed by the Atlas Powder Company, Wilmington, Del.

Becomes Worthington Head.

CHARLES PHILIP COLEMAN, recently elected president of the Worthington Pump and Machinery Corporation, 115 Broadway, New York, N. Y., has had an experience which exceptionally fits him for the position. Mr. Coleman advances from the position of vice-president, held since May, 1916. He was, prior to that date, receiver of the International Steam Pump Company and associate compa-

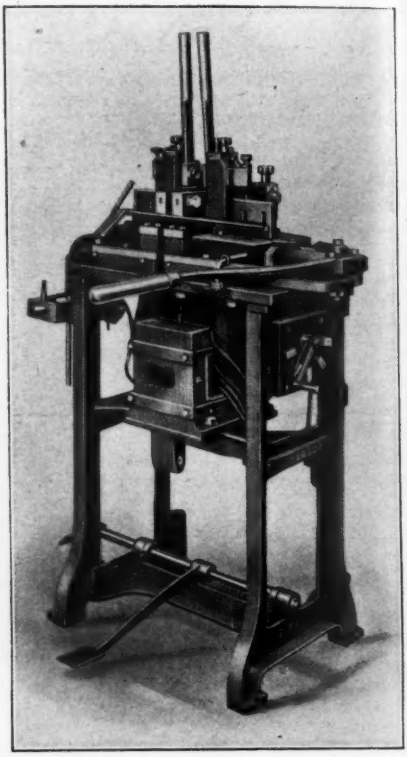
nies, which have now been reorganized into the present corporation, which owns and controls some of the best equipped works in the country. He graduated from Lehigh University and entered the employ of the Lehigh Valley Railroad Company and continued until 1903, with the exception of two years with the Bethlehem Steel Company as purchasing agent and assistant to the president, from which he returned to the Lehigh as general purchasing agent.

The Singer Sewing Machine Company made Mr. Coleman its secretary and treasurer in 1903, and during his incumbency he had charge of the construction of the Singer building. After leaving the Singer company he became president of the Saurer Motor Company and afterward of the International Motor Company. He came to the International Steam Pump Company in 1913 as vice-president. After the reorganization into the present Worthington Pump and Machinery Corporation the vice-presidency was again given Mr. Coleman. The corporation has eight large works in this country and an European works. The standard products, aside from pumping machinery, cover mining and concentrating machinery, oil and gas engines, air compressors, gas power engines and blowers, crushing and cement equipment, water works engines and special machinery.

It Welds Things.

THE THOMSON electric butt-welder, pictured here, is designed for welding round and flat stock in accurate alignment. The abutting ends of the pieces to be welded are held in the copper dies by two vertical clamps operated by hand cam-levers. The current is turned on by pressing the foot-treadle or hand-lever switch, and the pieces become heated. Pressure at the point of weld is applied by a toggle lever, the current turned off, and the weld is made.

At the plant of the Vermont Marble Company, Proctor, Vermont, a type 10-A machine is used for the purpose of welding the good ends of all old saws together, therefore making new saws. Some of the saws in use are nearly 25 feet long, and when in the process of sawing the blades become



worn away and are usually discarded and replaced by new ones, despite the fact that the sections at either end have not worn at all, not coming in contact with the marble. These range from 12 inches to 5 feet long.

Under the present system, the good ends are cut off of all the old saws and welded together with the machine into new ones. The welding machine was supplied by the Thomson Electric Welding Company, Lynn, Mass.

Du Pont Photo Contest.

TO INCREASE interest in Du Pont products and secure suitable photographs to illustrate the advertising and publicity of their various companies, the Du Pont American Industries have offered $500 in prizes for the 50 best photographs, as follows: First prize, $100; second prize, $50; two third prizes, $25 each; fourteen fourth prizes, $10 each; and thirty-two fifth prizes, $5 each. The pictures

are to illustrate the agricultural uses of explosives, fabrikoid (artificial leather), industrial uses of explosives, painting, trap shooting and hunting, and miscellaneous. The contest will close September 1st. All photographs must be plainly marked "Photograph Contest" and mailed to the Avertising Division, Du Pont Company, Wilmington, Delaware, full postage prepaid. Applicants should obtain particulars of the contest before submitting pictures.

Machinery Men to Hold War Convention.

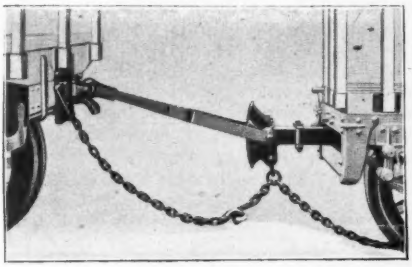
THERE WILL BE a war convention of the machinery, tool and supply industries of the country in Cleveland, Ohio, the week of May 13th. The purpose is to lay out a plan of aiding Government officials to keep the munition progress going at top speed. The occasion will be a joint meeting of the American Supply and Machinery Manufacturers' Association, the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the National Pipe and Supplies Association. Their slogan will be, "More ships, more shells."

Erie's New England Representative.

E. L. SPARKS, lately industrial engineer of Engineering News-Record, has been appointed New England representative of the Ball Engine Company, manufacturer of Erie revolving steam shovels at Erie, Pa. He is a graduate of the Central manual training school of Philadelphia, and has had extensive railroad construction experience of varied character since 1902. He began with the M., K. & T., and has done work for the Big Four, Southern Pacific and C., M. & St. P. railroads. Possibly his most important duties were those in connection with the Southern Pacific exploration survey in the upper Yaqui Canon, in the state of Sonora, Mexico, and in the Navajo Indian Reservation, in New Mexico, where he served as locating engineer of a new line across the reservation. In 1914 he joined the Engineering Record staff as a writer of advertising for construction equipment, remaining with the paper after its consolidation with Engineering News, being appointed industrial editor in 1917, from which position he resigned to take up the New England representation of the Ball Engine Company.

New Automatic Truck Hitch.

HEREWITH is pictured the new automatic truck hitch of the Troy Wagon Works Company, Troy, Ohio. The hitch couples automatically, the



operator being merely required to raise the hand-lever and part the jaws, back the truck slowly, steer the connecting bar into the apron of the hitch from any angle, which guides it into the jaws and trips the lock, thus completing the coupling. To uncouple, the operator simply raises the hand-lever and the truck pulls away. It is impossible for the jaws to open and release the connecting bar until the hand-lever is raised by the operator. The hitch is strongly made, the main casting being malleable iron and the two jaws cast steel. Each part is carefully machined and assembled, so that there will be no rattle or lost motion.

I like the pep that you display all the way through, and you have made the articles most interesting. This is just the journal I wanted.—C. S. Peck, Oklahoma Glass-Sand Co., Hickory, Okla.

Building and Maintenance of Macadam Roads

BY W. O. JONES
County Highway Superintendent, Richmond, Ind.

Of two generally accepted methods of building macadam roads, the one used most, that of removing all the old roadbed, is the most expensive and least practical. I have found from personal experience that a much cheaper and better way is to keep the old, travel-hardened roadbed, made solid by years of traffic.

Scarify the old roadbed until it will grip the new material, and throw up your berm alongside at the proper width. Then put the stone on top of the old roadbed, using only about half of the usual amount. This makes a better and more solid roadbed.

Roll the stone down until solid, in the usual manner. After making a satisfactory surface of stone, with the crown properly raised for drainage, put on screenings lightly, taking care to cover all voids and make a smooth surface. Then you are ready for water, which you can never get too much of. Have the sprinkler go just ahead of the roller and roll from the outside of the road to the center to make your crown.

Treatment of Foundation

If the method is used by which the profiles and plans of the engineer are to be followed, the first thing to be considered is the sub-grade or foundation. In this method, all dirt from the old roadway is removed to a depth of 10 or 12 inches, which is purely a matter of local policy.

The foundation should be rolled with a 10 or 12-ton roller until solid, and if there are any soft or spongy places, these should be filled with suitable material and rolled. When the rolling is completed the sub-grade should be solid and of proper shape for drainage.

Completing this, throw up an earth berm along the side, giving proper width. Then the first course of stone should be put on at a depth of 5 inches and rolled until solid and smooth. You are then ready for the second course of stone, which should be put on at a depth of 4 or 5 inches and rolled until ready for screenings and water, the more water the better.

Importance of Maintenance

The most important part in the existence of a macadam road is its maintenance. Too many people think that when a road is built there will be nothing more to do on it for years, but this is a serious mistake. I believe the maintenance should begin the first year and continue indefinitely. It is far less expensive in a number of years to keep the macadam roads smooth and free from depressions by numerous small repairs than by a few big ones. Observe all macadam roads closely, fill the holes and depressions and keep up the edges to prevent raveling.

When the road gets too rough, a little scarifying and resurfacing will make a new road. Use plenty of water when rolling down the screenings, but watch the drainage so the road does not have puddles after it is in use.

You hear a great many people say, "Oh, that road is about worn out," and why is it? Simply because the road has never had any attention and no one has looked after it for years, possibly.

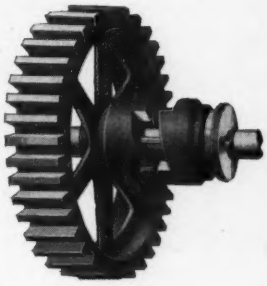
I think there can be no better road built for the money than a water-bound macadam. There is no wear-out to them. Look after them as you do your other roads and you will have a nice, smooth, well-appearing road for years.

Future Concrete to Be 1:10.

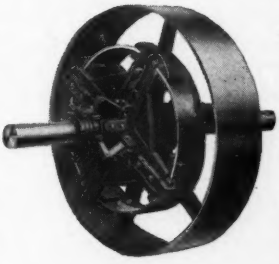
"As to the use of concrete becomes more general as a construction material," says W. P. Carmichael, president of the Carmichael Gravel Co., Williamsport, Ind., "and as its field broadens, scientific study of its materials and processes become a logical

Built for Hard Service

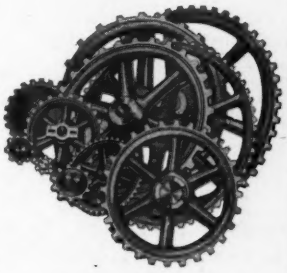
Our machinery is designed and built to stand the hard, continuous grinding requirements such as are found in SAND, STONE AND GRAVEL PLANTS. The results of over forty years experience are sold you when you purchase Caldwell Machinery.



GEARS—made of cast iron, semi-steel or cast steel, with machine molded or cut teeth. We have the most complete line of gear patterns and equipment of anyone in the United States.

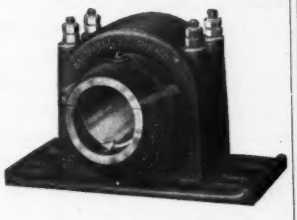


FRICTION CLUTCHES. We manufacture a number of different types of friction clutches to suit varying requirements. Clutch Pulleys and Cut-Off Couplings. Standard cast iron pulleys, Fly-Wheels and Rope Sheaves up to 20 feet diameter.



CHILLED RIM SPROCKETS—will wear two to five times as long as regular grey iron wheels.

BEARINGS. We have a complete line of pillow block bearings, drop hangers, and post hangers, in rigid and adjustable types, heavy and extra heavy patterns.



Our line of ELEVATING, CONVEYING and POWER TRANSMITTING MACHINERY is complete and is fully illustrated in our 800 page catalogue No. 38. If you do not have a copy better send for one.

H. W. CALDWELL & SON COMPANY

Western Ave. 17th and 18th Sts. **CHICAGO**

necessity and by such study we may expect that these processes will be refined and the best results ultimately attained. The determination of proportions and processes of manufacture will be done as carefully and by men as well trained in future as is now the practice in the steel industry, and the result will be an economical material of uniform quality. When concrete is made under such conditions and in such manner, instead of the customary allowable stresses in direct compressions of 500 to 750 pounds per square inch, these will be increased to 1000, 1500 or even higher allowable limits; and instead of a proportion of cement to all aggregates by volume of one to six, reinforced concrete will be made with a proportion of one part cement to ten or more parts of all aggregates."

Cement Breaks Record.

FROM U. S. GEOLOGICAL SURVEY

THE YEAR 1917 holds the record for production of Portland cement, a total of approximately 93,554,000 barrels having been manufactured, an excess over the former high production of 1913 of nearly 1,500,000 barrels, and over the production of 1916 of more than 2,000,000 barrels, or 2.2 per cent. The shipments in 1917 of approximately 90,630,000 barrels fell below those of the record year, 1916, by nearly 4,000,000 barrels, or about 4 per cent. Stocks at mills increased more than 2,800,000 barrels, or 33.7 per cent, as compared with 1916.

Higher prices for cement prevailed throughout the United States, except at a few plants in the Pacific Coast district. Higher prices were, however, accompanied by higher costs of manufacture. Demand for cement was generally very good during the first five to eight months of 1917, but showed a decided falling off during the remainder of the year. Labor and traffic conditions were, for the most part, unsatisfactory.

Production of Lime.

THE ESTIMATED production of lime made and sold in 1917 in the United States, including Porto Rico and Hawaii, was 3,663,818 short tons, a decrease of 10 per cent compared with the revised total for the record year, 1916, which was 4,073,433 short tons. It surpassed, however, all records, previous to 1916. This estimate is based on returns made by the principal producers to G. F. Laughlin, of the United States Geological Survey, Department of the Interior.

The prices of lime, which generally increased in 1916, continued to rise throughout the country in 1917, though not in proportion to the continued increase in cost of production. A few companies in widely separated parts of the country were obliged to close their plants, partly on account of excessive costs but particularly because of shortage in fuel and labor. These conditions and a shortage of railway cars caused decreased production even where the demand for lime was reported good.

Road Types in Lincoln Highway.

WORK DONE upon the Lincoln Highway from coast to coast includes the following types and the mileage of each:

Concrete	227 miles
Brick	104 miles
Bituminous macadam, resurfaced	395 miles
Macadam, new construction.	37 miles
Macadam, resurfaced	275 miles
Gravel	415 miles
Natural dirt road graded	750 miles